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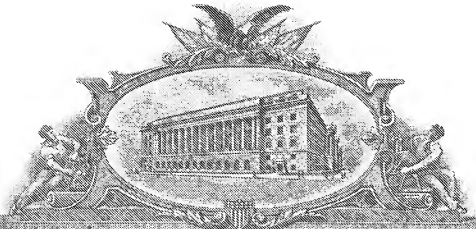

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PROVISIONAL PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Docket No: 20004/234US-PROV

PROVISIONAL PATENT APPLICATION TRANSMITTAL

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Sir:

Transmitted herewith for filing is the provisional patent application under 37 CFR 1.53(c) of

Inventors: **Ramaswamy et al.**

Residence: Florida

Title: **METHODS AND APPARATUS TO DETERMINE AUDIENCE VIEWING OF VIDEO-ON-DEMAND PROGRAMS**

1. Application Papers Enclosed

1 Title Page

45 Pages of Specification
(excluding Claims, Abstract, Sequence Listing & Drawings)

0 Page(s) of Claims

1 Page(s) of Abstract

22 Sheet(s) of Drawings (Figs. 1 to 22)

☒ Formal
☐ Informal

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this Provisional Patent Application Transmittal and the documents referred to as enclosed therewith are being deposited with the United States Postal Service on **February 18, 2004** in an envelope addressed to Mail Stop Provisional Patent Application, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 utilizing the "Express Mail Post Office to Addressee" service of the United States Postal Service under Mailing Label No. **EV 403728292 US**.

Charissa Wheeler

2. **Small Entity Status**

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A small entity statement is(are) attached.

3. **Additional Papers Enclosed**

☐ Declaration of Biological Deposit

☐ Computer readable copy of sequence listing containing nucleotide and/or amino acid sequence

☐ Microfiche computer program

☐ Associate power of attorney

☐ Verified translation of a non-English patent application

☐ An assignment of the invention

☒ Return Receipt Postcard

☐ Other (e.g. declaration or oath)

4. **Filing Fee Calculation (37 CFR 1.16)**

☒	Provisional Application ($80.00/$160.00)	Filing Fee:	$160.00
☐	Other Fees (e.g. Recording Assignment)	Filing Fee:	
		Total Fees Enclosed:	**$160.00**

5. **Method of Payment of Fees**

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6. **Deposit Account and Refund Authorization**

The Commissioner is hereby authorized to charge any deficiency in the amount enclosed or any additional fees which may be required during the pendency of this application under 37 CFR 1.16 or 37 CFR 1.17 or under other applicable rules (except payment of issue fees), to Deposit Account No. 50-2455. A copy of this Transmittal is enclosed.

Please refund any overpayment to Grossman & Flight, LLC at the address below.

7. **Correspondence Address**

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February 18, 2004

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Charissa Wheeler

PROVISIONAL APPLICATION FOR UNITED STATES LETTERS PATENT

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that I, **Arun Ramaswamy**, a citizen of the United States of America, residing at 10710 Tavistock Drive, Tampa Florida 33623 have invented new and useful **METHODS AND APPARATUS TO DETERMINE AUDIENCE VIEWING OF VIDEO-ON-DEMAND PROGRAMS**, of which the following is a specification. My legal representative for this provisional patent application is Mark G. Hanley (Reg. No. 44,736) of Grossman & Flight, 20 N. Wacker Drive Suite 4220, Chicago, IL 60606; phone 312.580.1020.

METHODS AND APPARATUS TO DETERMINE AUDIENCE VIEWING OF VIDEO-ON-DEMAND PROGRAMS

FIELD OF THE DISCLOSURE

[0001] This disclosure relates generally to audience measurement and, more particularly, to methods and apparatus to determine audience viewing of video-on-demand programs.

BACKGROUND

[0002] Television ratings and metering information is typically generated by collecting viewing records and/or other viewing information from a group of statistically selected households. Each of the statistically selected households typically has a data logging and processing unit commonly referred to as a "home unit." In households having multiple viewing sites (e.g., multiple television systems), the data logging and processing functionality may be distributed among a single home unit and multiple "site units," one site unit for each viewing site. The home unit (or the combination of the home unit and the site unit) is often in communication with a variety of attachments that provide inputs to the home unit or receive outputs from the home unit. For example, a source identification unit such as a frequency detector attachment may be in communication with a television to sense a local oscillator frequency of the television tuner. In this manner, the frequency detector attachment may be used to determine the channel to which the television is currently tuned based on a detected frequency. Additional

source identification devices, such as on-screen readers and light-emitting-diode (LED) display readers, may be provided, for example, to determine if the television is operating (i.e., is turned ON) and/or the channel to which the television is tuned. A people counter may be located in the viewing space of the television and in communication with the home unit, thereby enabling the home unit to detect the identities and/or number of the persons currently viewing programs displayed on the television.

[0003] The home unit usually processes the inputs (e.g., channel tuning information, viewer identities, etc.) from the attachments to produce viewing records. Viewing records may be generated on a periodic basis (e.g., at fixed time intervals) and/or may be generated in response to a change in an input, such as a change in the identities of the persons viewing the television, a change in the channel tuning information (i.e., a channel change), etc. Each viewing record typically contains channel information, such as a channel number and/or station identification (ID), and a time (e.g., a date and time-of-day) at which the channel was displayed. In cases in which the program content being displayed is associated with a local audio/video content delivery device, such as a digital video disk (DVD) player, a digital video recorder (DVR), a video cassette recorder (VCR), etc., the viewing records may include content identification (i.e., program identification) information as well as information relating to the time and manner in which the associated content was displayed. Viewing records may also contain additional information, such as the number of viewers present at the viewing time.

[0004] The home unit typically collects a quantity of viewing records and periodically (e.g., daily) transmits the collected viewing records to a central office or data processing facility for further processing or analysis. The central data processing facility receives viewing records from home units located in some or all of the statistically selected households and analyzes the viewing records to ascertain the viewing behaviors of households in a geographic area or market of interest, a particular household and/or a particular group of households selected from all participating households. Additionally, the central data processing facility may generate metering statistics and other parameters indicative of viewing behavior associated with some or all of the participating households. This data may be extrapolated to reflect the viewing behaviors of markets and/or regions modeled by the statistically selected households.

[0005] To generate viewing behavior information from viewing records, the central office or data processing facility may compare reference data, such as a list of programs (e.g., a schedule of television programming or a television guide), to the viewing records. In this manner, the central office can infer which program was displayed by cross-referencing the time and channel information in a viewing record to the program associated with that same time and channel in the program schedule. Such a cross-referencing process can be carried out for each of the viewing records received by the central office, thereby enabling the central office to reconstruct which programs were displayed by the selected households and the times at which the programs were displayed. Of course, the aforementioned cross-

referencing process is unnecessary in systems in which the identity of the program is obtained by the home unit and contained in the viewing record.

[0006] The rapid development and deployment of a wide variety of audio/video content delivery and distribution platforms has dramatically complicated the home unit task of providing viewing records or information to the central data collection facility. For instance, while the above-mentioned frequency detector device can be used to detect channel information at a site where network television broadcasts are being displayed (because, under normal operation conditions, the local oscillator frequency corresponds to a known network channel), such a device typically cannot be used with digital broadcast systems. In particular, digital broadcast systems (e.g., satellite-based digital television systems, digital cable systems, etc.) typically include a digital receiver or set-top box at each subscriber site. The digital receiver or set-top box demodulates a multi-program data stream, parses the multi-program data stream into individual audio and/or video data packets, and selectively processes those data packets to generate an audio/video signal for a desired program. The audio and/or video output signals generated by the set-top box can be directly coupled to an audio/video input of an output device (e.g., a television, a video monitor, etc.) As a result, the local oscillator frequency of the output device tuner, if any, does not necessarily identify the channel or program currently being displayed.

[0007] To allow generation of meaningful viewing records in cases wherein, for example, the network channel is not readily identifiable or may not uniquely correspond to a displayed program, metering techniques based on

the use of ancillary codes and/or content signatures may be employed. Metering techniques that rely on ancillary codes often encode and embed identifying information (e.g., a broadcast/network channel number, a program identification code, a broadcast time stamp, a source identifier to identify a network and/or station providing and/or broadcasting the content, etc.) in the broadcast signal such that the code is not noticed by the viewer. For example, a well-known technique used in television broadcasting involves embedding the ancillary codes in the non-viewable vertical blanking interval of the video signal. Another example involves embedding the ancillary codes in non-audible portions of the audio signal accompanying the broadcast program. This latter technique is especially advantageous because the ancillary code may be reproduced by, for example, the television speaker and non-intrusively monitored by an external sensor, such as a microphone.

[0008] In general, signature-based program identification techniques use one or more characteristics of the currently displayed (but not yet identified) audio/video content to generate a substantially unique proxy or signature (e.g., a series of digital values, a waveform, etc.) for that content. The signature information for the content being displayed may be compared to a set of reference signatures corresponding to a known set of programs. When a substantial match is found, the currently displayed program content can be identified with a relatively high probability.

[0009] While the known apparatus and techniques described above are well suited for generating viewing records associated with live viewing of broadcast television programming, they may not be directly applicable to the

generation of viewing records associated with video-on-demand (VOD) programs. In a VOD system, a subscriber may select among a potentially large collection of programming content to be transmitted to the specific subscriber's home for immediate viewing or for viewing at a later time. Thus, existing metering techniques based on cross-referencing a predetermined broadcast programming guide or television listing are not applicable because the content to be transmitted to the subscriber's home is not known prior to when the subscriber makes the selection. Thus, existing techniques would require a computationally expensive brute-force search over all possible reference broadcast and VOD content to determine the specific VOD content being consumed at the subscriber's home (because existing metering techniques typically do not distinguish whether the source of the consumed programming content is a broadcast or a VOD source). Moreover, the existing metering techniques may not be able to distinguish between content that may be provided by both a broadcast provider and a VOD provider and, as such, may incorrectly credit the source of the consumed programming content.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a block diagram of an example local metering system coupled to an example home entertainment system.

[0011] FIG. 2 is a block diagram of an example broadcast system and an example monitoring system.

[0012] FIG. 3 is a block diagram of an example monitoring system for video-on-demand (VOD) programming that may employ metered data from a VOD server and/or a statistically selected home.

[0013] FIG. 4 is a block diagram of an example monitoring system for VOD programming that may employ back-channel monitoring of a VOD provider.

[0014] FIG. 5 is a block diagram of an example monitoring system for VOD programming that may employ metered data from a subscriber set-top box (STB).

[0015] FIG. 6 is a block diagram of an example monitoring system for VOD programming that may employ metered data from an on-screen display reader (OSDR).

[0016] FIG. 7 is a block diagram of an example monitoring system for VOD programming that may employ broadcast channel monitoring and/or back-channel monitoring of an STB.

[0017] FIG. 8 is a block diagram of an example monitoring system for VOD programming that may employ metadata to monitor viewing of VOD content.

[0018] FIG. 9 is a flowchart of an example process for monitoring VOD programming that may employ metered data from a VOD server.

[0019] FIG. 10 is a flowchart of an example process for monitoring VOD programming that may employ back-channel monitoring of a VOD provider.

[0020] FIG. 11 is a flowchart of an example process for monitoring VOD programming that may employ software meter data from an STB.

[0021] FIG. 12 is a flowchart of an example process for monitoring VOD programming that may employ monitoring the internal operation of a STB.

[0022] FIG. 13 is a flowchart of an example process for monitoring VOD programming that may employ STB reporting directly to a central facility.

[0023] FIG. 14 is a flowchart of an example process for monitoring VOD programming that may employ metered data from an OSDR.

[0024] FIG. 15 is a flowchart of an example process for monitoring VOD programming that may employ broadcast channel monitoring and/or back-channel monitoring of an STB.

[0025] FIG. 16 is a flowchart of an example process for monitoring VOD programming that may employ metered data from a VOD server and/or a statistically selected home.

[0026] FIGS. 17A and 17B are flowcharts of example processes for monitoring VOD programming that may employ metadata to monitor viewing of VOD content.

[0027] FIG. 18 is a flowchart of an example process for monitoring VOD programming that may employ a combination of metered data from an STB and from an OSDR.

[0028] FIG. 19 is a flowchart of an example process for monitoring VOD programming that may employ a combination of metered data from an

STB and/or an OSDR with generated content signatures to monitor viewing of VOD content.

[0029] FIG. 20 is a flowchart of an example process for monitoring VOD programming that may employ a combination of metered data from an STB and/or an OSDR with ancillary codes to monitor viewing of VOD content

[0030] FIGS. 21A and 21B are flowcharts of example processes for monitoring VOD programming that may employ a combination of metadata and metered data from a subscriber site to monitor viewing of VOD content.

[0031] FIG. 22 is a block diagram of an example computer that may be used to implement an example home unit of the example local metering system of FIG. 1.

DETAILED DESCRIPTION

[0032] A block diagram of an example local metering system 100 capable of providing viewing and metering information for video-on-demand program content via an example home entertainment system 102 is illustrated in FIG. 1. The example home entertainment system 102 includes a broadcast source 104, a set-top box (STB) 108, a signal splitter 116 and a television 120. The example local metering system 100 includes a home unit 124. The components of the home entertainment system 102 and the local metering system 100 may be connected in any well-known manner including that shown in FIG. 1. For example, in a statistically selected household having one or more home entertainment systems 102, the home unit 124 may be

implemented as a single home unit and one or more site units. In such a configuration, the single home unit performs the functions of storing data and forwarding the stored data to a central facility (such as the central facility 211 of FIG. 2 discussed below) for subsequent processing. Each site unit is coupled to a corresponding home entertainment system 102 and performs the functions of collecting viewing/metering data, processing such data (possibly in real-time) and sending the processed data to the single home unit for storing and subsequent reporting to the central facility.

[0033] The broadcast source 104 may be any broadcast media source, such as a cable television service provider, a satellite television service provider, a radio frequency (RF) television service provider, an internet streaming video/audio provider, etc. The broadcast source 104 may provide analog and/or digital television signals to the home entertainment system 102, for example, over a coaxial cable or via a wireless connection.

[0034] The STB 108 may be any set-top box, such as a cable television converter, a direct broadcast satellite (DBS) decoder, a video cassette recorder (VCR), etc. The set-top box 108 receives a plurality of broadcast channels from the broadcast source 104. Typically, the STB 108 selects one of the plurality of broadcast channels based on a user input, and outputs one or more signals received via the selected broadcast channel. In the case of an analog signal, the STB 108 tunes to a particular channel to obtain programming delivered on that channel. For a digital signal, the STB 108 may tune to a channel and decode certain packets of data to obtain programming delivered on a selected channel. For example, the STB 108 may tune a major channel

and then extract a program carried on a minor channel within the major channel via the decoding process mentioned above. For some home entertainment systems 102, for example, those in which the broadcast source 104 is a standard RF analog television service provider or a basic analog cable television service provider, the STB 108 may not be present as its function is performed by a tuner in the television 120.

[0035] An output from the STB 108 is fed to a signal splitter 116, such as a single analog y-splitter in the case of an RF coaxial connection between the STB 108 and the television 120 or an audio/video splitter in the case of a direct audio/video connection between the STB 108 and the television 120. (For configurations in which the STB 108 is not present, the broadcast source 104 may be coupled directly to the signal splitter 116). In the example home entertainment system 102, the signal splitter produces two signals indicative of the output from the STB 108. Of course, a person of ordinary skill in the art will readily appreciate that any number of signals may be produced by the signal splitter 116.

[0036] The STB 108 may also be coupled to a back-channel connection 128 to provide a return communication path to the broadcast signal provider corresponding to the broadcast source 104. The STB 108 may use the back-channel connection 128 to send billing and/or status information to the broadcast provider. The back-channel connection 128 may also allow a subscriber to use the STB 108 to request/order content for viewing on the television 120 (e.g., pay-per-view movies, video-on-demand programming,

etc.), purchase goods and/or services, modify the subscription package associated with the STB 108, etc.

[0037] In the illustrated example, one of the two signals from the signal splitter 116 is fed to the television 120 and the other signal is delivered to the home unit 124. The television 120 may be any type of television or television display device. For example, the television 120 may be a television and/or display device that supports the National Television Standards Committee (NTSC) standard, the Phase Alternating Line (PAL) standard, the Système Électronique pour Couleur avec Mémoire (SECAM) standard, a standard developed by the Advanced Television Systems Committee (ATSC), such as high definition television (HDTV), a standard developed by the Digital Video Broadcasting (DVB) Project, or may be a multimedia computer system, etc.

[0038] The second of the two signals from the signal splitter 116 (i.e., the signal carried by connection 136 in FIG. 1) is coupled to an input of the home unit 124. The home unit 124 is a data logging and processing unit that may be used to generate viewing records and other viewing information useful for determining viewing and other metering information. The home unit 124 typically collects a set of viewing records and transmits the collected viewing records over a connection 140 to a central office or data processing facility (not shown) for further processing or analysis. The connection 140 may be a telephone line, a return cable television connection, an RF or satellite connection, an internet connection or the like.

[0039] The home unit 124 may be configured to determine identifying information based on the signal corresponding to the program content being output by the STB 108. For example, the home unit 124 may be configured to decode an embedded ancillary code in the signal received via connection 136 that corresponds to the program currently being delivered by the STB 108 for display on the television 120. Alternatively or additionally, the home unit 124 may be configured to generate a program signature based on the signal received via connection 136 that corresponds to the program currently being delivered by the STB 108 for display on the television 120. The home unit may then add this program identifying information to the viewing records corresponding to the currently displayed program.

[0040] To facilitate the determination of program identifying information and the generation of viewing records for the currently displayed program content, the home unit 124 may also be provided with one or more sensors 144. For example, one of the sensors 144 may be a microphone placed in the proximity of the television 120 to receive audio signals corresponding to the program being displayed. The home unit 124 may then process the audio signals received from the microphone 144 to decode any embedded ancillary code(s) and/or generate one or more audio signatures corresponding to a program being displayed. Another of the sensors 144 may be an on-screen display detector for capturing images displayed on the television 120 and processing regions of interest in the displayed image. The regions of interest may correspond, for example, to a broadcast channel associated with the currently displayed program, a broadcast time associated

with the currently displayed program, a viewing time associated with the currently displayed program, etc. An example on-screen display detector is disclosed by Nelson, et al. in U.S. Provisional Patent Application Serial No. 60/523,444 which is hereby incorporated by reference. Yet another of the sensors 144 could be a frequency detector to determine, for example, the channel to which the television 120 is tuned. One having ordinary skill in the art will recognize that there are a variety of sensors 144 that may be coupled with the home unit 124 to facilitate generation of viewing records containing sufficient information for the central office to determine a set of desired ratings and/or metering results.

[0041] The example home entertainment system 102 also includes a remote control device 160 to transmit control information that may be received by any or all of the STB 108, the television 120 and the home unit 124. One having ordinary skill in the art will recognize that the remote control device 160 may transmit this information using a variety of techniques, including, but not limited to, infrared (IR) transmission, radio frequency transmission, wired/cabled connection, and the like.

[0042] The example local metering system 100 also includes a people meter 164 to capture information about the audience. The example people meter 164 may have a set of input keys, each assigned to represent a single viewer, and may prompt the audience members to indicate that they are present in the viewing audience by pressing the appropriate input key. The people meter 164 may also receive information from the home unit 124 to determine a time at which to prompt the audience members. Moreover, the

home unit 124 may receive information from the people meter 164 to modify an operation of the home unit 124 (such as causing the home unit to generate one or more viewing records based on a change in the viewing audience). As will be appreciated by one having ordinary skill in the art, the people meter 164 may receive and/or transmit information using a variety of techniques, including, but not limited to, infrared (IR) transmission, radio frequency transmission, wired/cabled connection, and the like. As will also be appreciated by one having ordinary skill in the art, the people meter 164 may be implemented by a combination of the remote control device 160 and one or more of the STB 108 and/or the home unit 124. In such an implementation, the STB 108 and/or the home unit 124 may be configured to display prompting information and/or other appropriate people meter content directly on the television 120. Correspondingly, the remote control device 160 may be configured to accept inputs from the viewing audience and transmit these user inputs to the appropriate device responsible for generating the people meter display on the television 120.

[0043] FIG. 2 illustrates an example monitoring system 200 to monitor viewing of program content provided by an example broadcast system 201. The example broadcast system 201 of FIG. 2 includes a broadcast station 202 that receives audio/video content from a plurality of content providers 204 and 206. The audio/video content providers 204 and 206 may provide audio and/or video programs or information, such as television programs, advertisements, audio (e.g., radio) programs, still image information (e.g., web pages), etc., in known manners to the broadcast station 202.

[0044] The example monitoring system 200 of FIG. 2 includes one or more reference sites 208, a plurality of local metering systems 209 (for example, a set of systems similar or identical to the local metering system 100 of FIG. 1) located at a plurality of home sites 210 (which may be statistically selected to represent a larger population) and a central facility 211 to compile and process data collected by the local metering systems 209. For ease of reference, only one home site 210, one reference site 208 and one central facility 211 is shown in FIG. 2. However, persons of ordinary skill in the art will appreciate that any number of home sites 210, reference sites 208 and/or central data collection and processing facilities 211 may be employed.

[0045] The broadcast station 202 transmits one or more signals containing digital and/or analog audio/video content information. These signals are received by at least one reference site 208 and at least one statistically selected home site 210 via communication paths or links 212 and 214, respectively. The communication paths or links 212 and 214 may include any combination of hardwired or wireless links, such as satellite links, wireless land-based links, cable links, etc. The signals conveyed via the links 212 and 214 may contain multi-program analog signals and/or digital data streams which are commonly employed within existing broadcast systems.

[0046] In the example monitoring system 200, the reference site 208 includes a plurality of receivers (e.g., set-top boxes or the like) 216, 218 and 220 that simultaneously demodulate, demultiplex and/or decode audio, video and/or other information received from the broadcast station 202. In the illustrated example, each of the receivers 216, 218 and 220 provides audio

and/or video information associated with a different program that is currently being broadcast to a reference site processor 222. In other words, the receiver 216 may provide audio and/or video information associated with a program A while the receivers 218 and 220 provide audio and/or video information associated with respective programs B and C. In addition, the reference site processor 222 is configured to control each of the receivers 216, 218 and 220 and/or has information indicating a program to which each of the receivers 216, 218 and 220 is tuned at any given time.

[0047] The reference site processor 222 may determine the original broadcast date/time stamps, decode reference ancillary code information and/or generate reference signature information for a plurality of simultaneously broadcast audio/video content. The reference site processor 222 sends the original broadcast time stamps and the reference code and/or signature information to a central facility processor 224 which stores the original broadcast time stamps and the reference code and/or signature information in a database 226.

[0048] The home site 210 could be, for example, a statistically selected home containing a television, a radio, a computer, etc. The home site 210 includes an output device 228 (e.g., a video display, speaker, etc., such as the television 120 of FIG. 1). The home site 210 also includes a receiver 230, such as the STB 108 of FIG. 1, which may be similar or identical to the receivers 216, 218 and 220. Such receivers are well-known and, thus, are not described in greater detail herein. The receiver 230 provides audio and/or

video signals 232 to the output device 228 that are used to present the program currently selected for consumption.

[0049] To monitor the use of the receiver 230, the home site 210 is provided with a local metering system 209, such as the local metering system 100 of FIG. 1. The local metering system 209 may include, for example, a home unit such as the home unit 124. The receiver 230 provides an audio and/or a video signal 234 containing audio and/or video information associated with the currently displayed program to the local metering system 209. The local metering system 209 uses the signal 234 to decode ancillary code information and/or generate signature information corresponding to the program currently being displayed on the output device 228. The local metering system 209 stores and periodically conveys this code and/or signature information to the central facility processor 224, for example, in the form of a viewing record or set of records.

[0050] The central facility processor 224, in addition to being able to perform other processing tasks, is configured to compare code and/or signature information generated at the home site 210 to the reference code and/or signature information stored in the database 226 to identify the channels and/or programs that were displayed at the home site 210. To facilitate the comparison of code and/or signature information received from the reference site 208 to the code and/or signature information received from the home site 210, the reference site processor 222 and the local metering system 209 may generate time stamp information and associate such time stamp information with the code and/or signature information collected at the

corresponding time. In this manner, the central facility processor 224 can attempt to align the code and/or signature information received from the reference sites 208 with the code and/or signature information collected at the corresponding times via the home site 210 to thereby reduce the number of comparisons required to identify a match.

[0051] As mentioned previously, existing content metering techniques may not be suitable for monitoring viewing of video-on-demand (VOD) programming content. For example, a broadcast programming guide (or equivalent mapping of content to broadcast time) is generally not available in the case of VOD programming. Moreover, similar programming content may be available from both a VOD server and another broadcast source (e.g., another broadcast station, cable channel, etc.). In the latter case, the existing content metering approaches may not be able to distinguish the source of the consumed content and, therefore, may generate erroneous crediting results. Thus, it is desirable to determine if the consumed content is being provided by a VOD source and/or to narrow the universe of possible programming content that is cross-referenced to match the consumed content with a known reference. Methods and apparatus to address at least some of these limitations are discussed in the following figure descriptions. A particular method and/or apparatus may be preferred depending on the capabilities of the multiple service operator (MSO) providing the VOD service, the characteristics of the equipment used to implement the VOD system, the access to data stored in and/or generated by the VOD server(s), the access to data and/or operational

information corresponding to the subscriber STB (e.g., the STB 108 of FIG. 1), etc.

[0052] FIG. 3 illustrates an example monitoring system for video-on-demand (VOD) programming that may employ metered data from a VOD server and/or a statistically selected home. In the example environment of use of FIG. 3, the VOD system includes a VOD server 304, a distribution network 308 and multiple subscriber STBs 312, 316. The VOD server 304 may be implemented as a single server or a collection of servers located in a central location or multiple, distributed geographical locations. The VOD server 304 stores the VOD content to be transmitted to the subscriber STBs 312, 316. The distribution network 308 may be any distribution network that is able to transmit VOD content to a subscriber location (e.g., an RF television broadcaster, a cable television service provider, a satellite service provider, etc.). The subscriber STBs 312, 316 may be any set-top box, such as the STB 108 of FIG. 1.

[0053] The example monitoring system of FIG. 3 includes a metering home interface 320, such as the home unit 124 of FIG. 1, coupled to the STB 316. The metering home interface 320 may be used to collect viewing data (e.g., TV ON/OFF data, tuning data, content codes, content signatures, etc.), audience demographics (e.g., via the people meter 164), etc. The example monitoring system also includes a metering server interface 324 to collect data from the VOD server 304. The data may be stored in any appropriate format, for example, an XML format or equivalent, and may include VOD content information, such as the VOD content title, the associated metadata for the

VOD content and other subscriber information, such as an STB identifier (ID) for a given subscriber's STB. The metered server data may correspond to all VOD service subscribers, instead of being limited to only those subscribers included in a statistical sampling of selected households.

[0054] The example monitoring system of FIG. 3 also includes a central facility 328, such as the central facility 211 of FIG. 2. The central facility 328 may receive information from the metering server interface 324 and/or the metering home interface 320. The central facility 328 may combine the information received from both the metering server interface 324 and/or the metering home interface 320 to credit VOD programming and to generate corresponding usage and demographic reports. For example, the central facility 328 may use the STB ID for the STB 316 to match the data from metering home interface 320 to the corresponding data received from the metering server interface 324.

[0055] FIG. 4 illustrates an example monitoring system for VOD programming that may employ back-channel monitoring of a VOD provider. As for the example of FIG. 3, the example environment of use of FIG. 4 comprises a VOD system that includes a VOD server 404, a distribution network 408 and multiple subscriber STBs 412, 416. For brevity, the functionality of these elements is not re-described here. Rather, the interested reader is referred to the detailed description of the corresponding blocks in FIG. 3.

[0056] The example monitoring system of FIG. 4 includes a back-channel monitor 420 to monitor the information received by the VOD service

provider via a back-channel connection, such as the back-channel connection 128 of FIG. 1. The back-channel monitor 420 may receive VOD-related information being transmitted by the STB 416 to the VOD service provider. This information may include subscriber requests to order VOD content, billing information, the STB ID corresponding to the STB 416, etc. The back-channel monitor 420 sends the collected back-channel information to a central facility 424, such as the central facility 211 of FIG. 2. The central facility 424 may use the reported back-channel information to credit viewing of a requested VOD program and to generate additional content metering reports.

[0057] FIG. 5 illustrates an example monitoring system for VOD programming that may employ metered data from a subscriber set-top box (STB). As in the example of FIG. 3, the example environment of use of FIG. 5 comprises a VOD system that includes a VOD server 504, a distribution network 508 and multiple subscriber STBs 512, 516. For brevity, the functionality of these elements is not re-described here. Rather, the interested reader is referred to the detailed description of the corresponding blocks in FIG. 3.

[0058] The example monitoring system of FIG. 5 includes an STB monitoring interface 520 coupled to the STB 516. The STB monitoring interface may be implemented by a software meter running in the STB 516 to collect and report, for example, VOD usage data, coupled to a home unit, such as the home unit 124 of FIG. 1. Alternatively or additionally, the STB monitoring interface 520 may be a device coupled to the internal communication buses and/or interfaces of the STB 516 (such as the

communication buses and/or interfaces described in FIG. 22 below). In this case, the STB monitoring interface 520 may be configured to determine the operating state of the STB 516 based on the transactions monitored on the communications buses/interfaces. The STB monitoring interface 520 may also be configured to read and/or process data stored internally in the STB 516.

[0059] The STB monitoring interface 520 sends collected metering data to a central facility 524. The collected metering data may include VOD activity information (e.g., an indication that a VOD virtual channel was selected), VOD identification information (e.g., the title of the VOD content as stored in memory within the STB 516), public content identifiers included in the VOD data bit stream (e.g., fields in an MPEG-2 data format), etc. The reported data may also included other viewing information (e.g., TV ON/OFF data, tuning data, content codes, content signatures, etc.), audience demographics (e.g., via the people meter 164), etc. The central facility 524 may also receive VOD title information from the VOD server 504 that may be used, for example, to further validate the information reported by the STB monitoring interface 520.

[0060] FIG. 6 illustrates an example monitoring system for VOD programming that may employ metered data from an on-screen display reader (OSDR). As in the example of FIG. 3, the example environment of use of FIG. 6 comprises a VOD system that includes a VOD server 604, a distribution network 608 and multiple subscriber STBs 612, 616. For brevity, the functionality of these elements is not re-described here. Rather, the

interested reader is referred to the detailed description of the corresponding blocks in FIG. 3.

[0061] The example monitoring system of FIG. 6 includes an ancillary attachment 620 coupled to the STB 616. The ancillary attachment 620 may be implemented by a home unit, such as the home unit 124 of FIG. 1, to monitor, for example, whether the STB 616 has selected a VOD virtual channel over which VOD content may be received. Additionally, the example monitoring system includes an on-screen device reader (OSDR) 622 coupled to the STB 616. The example OSDR 622 includes a framegrabber and optical character recognition (OCR) engine to capture video screenshots corresponding to the output of the STB 616 and process such screenshots to determine viewing-related information. For example, the OSDR 622 may be used to capture VOD channel and/or title information from the video signal output by the STB 616. The OSDR may also be used to capture other viewing-related information from the screenshot (e.g., displaying of a viewing guide, entering an audio mute state, etc.). An example OSDR is disclosed by Nelson, et al. in U.S. Provisional Patent Application Serial No. 60/523,444 which was previously incorporated by reference.

[0062] The OSDR 622 (possibly in conjunction with a home unit, such as the home unit 124 of FIG. 1) sends collected metering data to a central facility 624. The collected metering data may include VOD activity information (e.g., an indication that a VOD virtual channel was selected as determined by the ancillary attachment 620), VOD identification information (e.g., the title of the VOD content as determined by the OSDR 622), etc. The

reported data may also included other viewing information (e.g., TV ON/OFF data, tuning data, content codes, content signatures, etc.), audience demographics (e.g., via the people meter 164), etc. The central facility 624 may also receive VOD title information from the VOD server 604 that may be used, for example, to further validate the information reported by the OSDR 622 (and an associated home unit 124 if present).

[0063] FIG. 7 illustrates an example monitoring system for VOD programming that may employ broadcast channel monitoring and/or back-channel monitoring of an STB. As in the example of FIG. 3, the example environment of use of FIG. 7 comprises a VOD system that includes a VOD server 704, a distribution network 708 and multiple subscriber STBs 712, 716. For brevity, the functionality of these elements is not re-described here. Rather, the interested reader is referred to the detailed description of the corresponding blocks in FIG. 3.

[0064] The example monitoring system of FIG. 7 includes a monitoring device 720 coupled to the back-channel connection 724 from the STB 716. The back-channel connection 724 may be any type of network connection, e.g., a dial-up phone line connection, an internet connection (e.g., via an Ethernet, broadband and/or dial-up access provider), a cellular/wireless connection, etc. Although not shown, the monitoring device 720, also known as a "sniffer" attachment 720, or an additional monitoring device 720 may also be coupled to the broadcast source connection 728 between the distribution network 708 and the STB 716. In the case of back-channel monitoring, the sniffer attachment 720 may be configured to process information transmitted

from the STB 716 back to the VOD service provider (e.g., by monitoring and decoding transmitted Internet Protocol (IP) packets). This information may include subscriber requests to order VOD content, billing information, the STB ID corresponding to the STB 716, etc. In the case of broadcast connection monitoring, the sniffer attachment 720 may be configured to process information transmitted by the distribution network 708 to the STB 716 (e.g., by monitoring and decoding the digital data packets that are transmitted in a known/standardized format, such as MPEG-2). This information may include, for example, public content identifiers associated with the displayed VOD programming content.

[0065] The sniffer attachment 720 sends the collected back-channel and/or broadcast channel information to a central facility 732, such as the central facility 211 of FIG. 2. The central facility 732 may use the reported back-channel and/or broadcast channel information to credit viewing of a requested VOD program and to generate additional content metering reports. The central facility 732 may also receive VOD title information from the VOD server 704 that may be used, for example, to further validate the information reported by the sniffer attachment 720 (and an associated home unit 124 if present).

[0066] FIG. 8 is a block diagram of an example monitoring system for VOD programming that may employ metadata to monitor viewing of VOD content. As in the example of FIG. 3, the example environment of use of FIG. 8 comprises a VOD system that includes a VOD server 804, a distribution network 808 and multiple subscriber STBs 812, 816. For brevity, the

functionality of these elements is not re-described here. Rather, the interested reader is referred to the detailed description of the corresponding blocks in FIG. 3.

[0067] The example monitoring system of FIG. 8 includes a number of tagger units 820 and 824. The tagger unit 820 may be used by a content provider to embed and/or generate metadata information for the VOD content to be stored in the VOD server 804. Such metadata information may include audio/video ancillary codes, audio/video signatures, digital content identifiers (IDs) (e.g., such as Aux Data private data supported by the AC3 audio standard), private content IDs (such as those supported by the MPEG-2 and/or AC3 standards), etc. The tagger unit 824 may also be included in the monitoring system to embed and/or generate additional metadata (e.g., an identifier for one or more distribution nodes used to store and route the VOD content to the subscriber site) corresponding to the VOD content as it is routed through the distribution network 808. Additionally or alternatively, the VOD server 804 may include tagger functionality to associate metadata with stored VOD content.

[0068] The example monitoring system of FIG. 8 also includes a tag metadata collector 828 to collect metadata information from any or all of the tagger unit 820, the tagger unit 824 and the VOD server 804. The metadata collector 828 provides the reported metadata to a central facility 832, such as the central facility 211 of FIG. 2. The central facility 832 may use the reported metadata to construct a reference database of possible VOD content and its associated metadata.

[0069] At the subscriber side, the example monitoring system of FIG. 8 includes a tag metadata extractor 836 coupled to the STB 816 (and/or an associated home unit, such as the home unit 124 of FIG. 1). The metadata extractor 836 may be configured to receive and/or process software meter data, internal bus transactions, internal data and/or the like from the STB 816. The metadata extractor 836 may also be configured to process the transmitted video/audio received by the STB 816 (e.g., via a splitter 116 as shown in FIG. 1). The metadata extractor 836 extracts and/or generates metadata corresponding to the VOD content received and output by the STB 816. For example, the metadata extractor 836 may extract the ancillary code, data content IDs and/or private content IDs embedded by the tagger units 820, 824 and/or the VOD server 804. Additionally or alternatively, the tag extractor 836 may generate audio/video signatures corresponding to the displayed VOD content.

[0070] After collection of the desired metadata, the tag extractor 836 (and/or a companion home unit 124 if present) sends the collected metadata to the central facility 832. The central facility 832 may cross-reference the reported metadata with the metadata contained in the reference database. The central facility 832 may then use the matched reference metadata to credit viewing of a requested VOD program and to generate additional content metering reports (e.g., based on additional metering information included in the metadata and/or additional viewing information and/or audience demographics reported by a home unit 124 located at the subscriber site).

[0071] FIGS. 9 to 21 illustrate example processes to monitor and/or meter audience viewing of VOD programs. The illustrated processes may be implemented by the apparatus and/or systems (or combinations thereof) shown in FIGS. 1 to 8. As indicated previously, a particular process may be preferred depending on the capabilities of the MSO providing the VOD service, the characteristics of the equipment used to implement the VOD system, the degree of access to data stored in and/or generated by the VOD server(s), the degree of access to data and/or operational information corresponding to the subscriber STB (e.g., the STB 108 of FIG. 1), etc.

[0072] The example processes of FIGS. 9 to 12 may be classified into the following three (3) broad categories of metering techniques: A) server site techniques, B) home site techniques and C) hybrid techniques. Server site metering techniques attempt to meter the viewing of VOD content based on information from only the VOD server/provider side of the VOD system. Home site metering techniques attempt to meter the viewing of VOD content based on information from only the subscriber side of the VOD system. Hybrid metering techniques attempt to meter the viewing of VOD content based on information from either or both of the VOD server/provider side and the subscriber side of the VOD system.

[0073] A) Server site techniques:

[0074] FIG. 9 illustrates an example process 900 for monitoring VOD programming that may employ metered data from a VOD server. The example process 900 begins at block 904 when a database of metering data is received from a VOD server, such as the VOD server 304 of FIG. 3. The

metering data may include, for example, VOD content titles, start/end times corresponding to the transmission of the VOD content, STB IDs corresponding to the subscriber STBs (e.g., STB 316) requesting the VOD content, etc. The process then cross-references the set of reported STB IDs against the STB IDs included in a statistically selected group of subscriber homes that are participating in the ratings/metering data collection (block 908). If a match is found at block 912, control proceeds to block 916 at which the process 900 extracts the reported VOD data corresponding to the selected STB ID. The process 900 then uses the extracted VOD server data to generate viewing statistics and crediting reports for the corresponding consumed VOD content (block 920). If a match is not found at block 912, control proceeds to block 924 at which the process 900 reports an error condition because no STB IDs corresponding to the set of statistically selected homes were found in the metering data provided by the VOD server at block 904.

[0075] FIG. 10 illustrates an example process 1000 for monitoring VOD programming that may employ back-channel monitoring of a VOD provider. The example process 1000 may be used in VOD systems in which back-channel reporting by a subscriber STB (e.g., the STB 416 of FIG. 4) is already supported and enabled (e.g., to provide ordering requests, billing information, etc., to the MSO providing the VOD service). The process 1000 begins at block 1004 when back-channel data is received by the MSO/VOD provider (e.g., via a back-channel monitor 420). The process 1004 then analyzes the back-channel data to determine if a VOD program was selected by a subscriber (block 1008). If at block 1012 the process 1000 determines

that a subscriber selected/ordered a VOD program, control proceeds to block 1014 at which the VOD data corresponding to the subscriber's STB ID is processed to extract the appropriate VOD metering data. Control then proceeds to block 1018. At block 1018 the extracted back-channel data is used to generate viewing statistics and/or crediting reports for the corresponding consumed VOD content. If at block 1012 the process 1000 determined that no subscriber selected/ordered VOD content, control returns to block 1004 and subsequent blocks thereto.

[0076] B) Home site techniques:

[0077] FIG. 11 illustrates an example process 1100 for monitoring VOD programming that may employ software meter data from an STB. The example process 1100 begins at block 1104 at which VOD usage information is collected from a subscriber STB (e.g., the STB 516 of FIG. 5). The process 1100 may collect such data via a STB monitoring interface 520 configured to process data generated by a software meter running in the STB 516. The collected VOD usage data may include VOD activity information (e.g., an indication that a VOD virtual channel was selected), VOD identification information (e.g., the title of the VOD content as stored in memory within the STB 516), public content identifiers included in the VOD data bit stream (e.g., fields in an MPEG-2 data format), etc. Control then proceeds to block 1108. At block 1108 additional viewing data is collected from the home site (e.g., embedded audio/video codes, generated audio/video signatures, television ON/OFF information, tuning information, special operating states such as mute, pause, rewind, fast-forward, etc., people meter audience statistics, etc.).

The VOD usage data and other viewing data are then reported to a central facility, such as the central facility 524 of FIG. 5 (block 1112).

[0078] After the VOD usage and other viewing information are reported, control proceeds to block 1116. At block 1116, the reported data is used to generate viewing statistics and crediting reports for the corresponding consumed VOD content. To generate such statistics and reports, "raw" VOD usage data, (e.g., bit fields contained in an MPEG-2 data stream corresponding to the received VOD programming content) may be processed. If the process 1100 is configured to receive VOD content title information from the VOD server (e.g., the VOD server 504 of FIG. 5) (block 1120), control proceeds to block 1124. At block 1124, the provided VOD content title information is used to validate the crediting reports generated in block 1116.

[0079] FIG. 12 illustrates an example process 1200 for monitoring VOD programming that may employ monitoring the internal operation of a STB. The example process 1200 begins at block 1204 at which state and/or other internal data/information is collected from a subscriber STB, such as the STB 516 of FIG. 5. The process 1200 may collect such information via a STB monitoring interface 520 that is coupled to the STB 516 and configured to monitor, for example, the internal bus transactions of the STB 516. The collected information may include, for example, VOD program requests, VOD content title information (e.g., read as ASCII data from a known memory map location), the STB ID corresponding to the STB 516, etc. Control then proceeds to block 1208 at which the collected STB state and/or other internal data is processed to determine VOD usage data (such as viewing of VOD

program content, VOD content identifiers, etc.). Control then proceeds to block 1108.

[0080] Blocks 1108, 1112, 1116, 1120 and 1124 of process 1200 are substantially identical to the corresponding blocks in the process 1100 of FIG. 11. For brevity, these blocks will not be re-described here. Rather, the interested reader is referred to the description of FIG. 11 for a detailed discussion of the above-identified blocks.

[0081] FIG. 13 illustrates an example process 1300 for monitoring VOD programming that may employ STB reporting directly to a central facility. The example process 1300 may be used in VOD systems in which the STB (such as the STB 108 of FIG. 1) is configured to report information directly to a monitoring central facility, such as the central facility 211 of FIG. 2. The example process 1300 begins when the STB 108 collects VOD usage information (block 1304). The STB 108 then reports such information directly to a central facility 211 (block 1308). Control then proceeds to block 1312 at which other viewing data may be collected as described above. The collected data may then be reported to the central facility 211 (block 1316). Control then proceeds to block 1116.

[0082] Blocks 1116, 1120 and 1124 of process 1300 are substantially identical to the corresponding blocks in the process 1100 of FIG. 11. For brevity, these blocks are not re-described here. Rather, the interested reader is referred to the description of FIG. 11 for a detailed discussion of the above-identified blocks.

[0083] FIG. 14 illustrates an example process 1400 for monitoring VOD programming that may employ metered data from an OSDR. The example process 1400 may be used in VOD monitoring systems that include an OSDR, such as the OSDR 622 of FIG. 6. The example process 1400 begins at block 1404 at which a VOD virtual channel or set of virtual channels over which VOD programming content may be transmitted by the network 608 to the STB 616 is monitored. The virtual channel may be monitored using one of many known ancillary attachments 620 capable of determining the channel selected by the STB 616. If a VOD channel is not selected (block 1408), control returns to block 1404 to wait for a VOD virtual channel to be selected. If, instead, a VOD virtual channel is selected (block 1408), control proceeds to block 1412 at which a screenshot corresponding to the video signal output by the STB 616 is captured (e.g., using a framegrabber included in the OSDR 622). Then, at block 1416 the screenshot is analyzed (e.g., using an OCR engine included in the OSDR 622) to determine VOD program identification and other usage information, such as the specific VOD virtual channel selected, the VOD program title, the time at which the VOD program was displayed, any special operating condition (e.g., mute, pause, rewind, fast-forward, etc.), etc. Control then proceeds to block 1108.

[0084] Blocks 1108, 1112, 1116, 1120 and 1124 of process 1400 are substantially equivalent to the corresponding blocks in the process 1100 of FIG. 11. For brevity, these blocks are not re-described here. Rather, the interested reader is referred to the description of FIG. 11 for a detailed discussion of the above-identified blocks.

[0085] FIG. 15 illustrates an example process 1500 for monitoring VOD programming that may employ broadcast channel monitoring and/or back-channel monitoring of an STB. The example process 1500 may be used in VOD monitoring systems that include a sniffer attachment, such as the sniffer attachment 720 of FIG. 7. The example process 1500 begins at block 1504 wherein the sniffer attachment determines if back-channel monitoring is enabled. If back-channel processing is enabled (block 1504), control proceeds the back-channel data is monitored via, for example, the sniffer attachment 720 (block 1508). Then, at block 1512, the back-channel data is processed to determine if a VOD program has been selected by the STB 716. If a VOD program has been selected (block 1516), control proceeds to block 1518. At block 1518, the back-channel data is processed to determine VOD usage information (e.g., VOD program title, start time, etc.). Otherwise, if a VOD program is not selected (block 1516), control may return to block 1508, to wait for a VOD program to be selected.

[0086] If back-channel monitoring is not enabled (block 1504) or after the processing at block 1518 is completed, control proceeds to block 1520. At block 1520, the sniffer attachment determines if broadcast channel monitoring is enabled. If broadcast processing is enabled (block 1520), control proceeds to block 1524. At block 1524, the broadcast data is monitored via, for example, the sniffer attachment 720. Then, at block 1528, the broadcast channel data is processed to determine if a VOD program has been selected by the STB 716. If a VOD program is selected (block 1532), control proceeds to block 1536 at which the broadcast channel data is analyzed to determine VOD

usage information (e.g., VOD program title, start time, etc.). Otherwise, if a VOD program has not been selected (block 1516), control may return to block 1524 to wait for a VOD program to be selected.

[0087] If broadcast channel monitoring is not enabled (block 1520) or after processing at block 1536 completes, control proceeds to block 1108. Blocks 1108, 1112, 1116, 1120 and 1124 of process 1500 are substantially equivalent to the corresponding blocks in the process 1100 of FIG. 11. For brevity, these blocks are not re-described here. Rather, the interested reader is referred to the description of FIG. 11 for a detailed discussion of the above-identified blocks.

[0088] C) Hybrid techniques:

[0089] FIG. 16 illustrates an example process 1600 for monitoring VOD programming that may employ metered data from a VOD server and/or a statistically selected home. The example process 1600 may be used in VOD monitoring systems that support metering server interfaces and/or metering home interfaces, such as the metering server interface 324 and metering home interface 320 of FIG. 3. The example process 1600 begins at block 1604 when metering data is received from a VOD server (e.g., the VOD server 304) via the metering server interface 324. Such data may include the VOD program title, start time, end time, subscriber ordering information, etc. Next, at block 1608, viewing data and metering information is collected from the corresponding subscriber site. Such information may be extracted from the signal providing the VOD program content via the metering home interface 320. The VOD server metering data/information is then cross-referenced with

the subscriber site metering data/information (e.g., via the STB ID of the STB 316) to associate VOD server data with the appropriate subscriber site data (block 1612). If a match is found (block 1616), control proceeds to block 1620 at which viewing statistics and crediting reports for the VOD programming content consumed at the selected subscriber site are generated. Otherwise, if a match is not found (block 1616), control may proceed to block 1624 at which statistical methods are used to combine the reported VOD server data with the reported subscriber side data (e.g., based on projecting the statistical characteristics of one of the VOD server data and the subscriber side data on the other of the subscriber side data and VOD server data).

[0090] FIGS. 17A and 17B illustrate example processes 1700 and 1750 for monitoring VOD programming that may employ metadata to monitor viewing of VOD content. The example processes 1700 and 1750 may be used in VOD monitoring systems that support the tagging of content with metadata via one or more tagger units at provider and/or distribution sites, and a metadata tag extractor at a subscriber site, such as the tagger units 820, 824 and the metadata extractor 836 of FIG. 8. The example process 1700 of FIG. 17A may be used to collect reference metadata information corresponding to VOD programming content. Such metadata information may include audio/video ancillary codes, audio/video signatures, digital content identifiers (IDs) (e.g., such as Aux Data private data supported by the AC3 audio standard), private content IDs (such as those supported by the MPEG-2 and/or AC3 standards), etc. The example process 1750 of FIG. 17B may be used to monitor and credit VOD programming content based on metadata information.

[0091] The example process 1700 begins at block 1704 at which the VOD content provider may embed metadata information into and/or generate metadata corresponding to a VOD program via a tagger unit 820. Next, control proceeds to block 1708 at which the VOD server 804 may associate additional metadata information with the VOD program. Control then proceeds to block 1712 at which the distribution network 808 may associate additional metadata information with the VOD program via the tagger unit 824. Finally, control proceeds to block 1716 at which the various tagger units 820, 824 and/or the VOD server 804 may report the metadata information to the central facility 832 to create a database of reference metadata information for possible VOD programming content.

[0092] Turning to the example process 1750, the process 1750 begins at block 1754 at which metadata information is extracted and/or program signatures are generated, for example, via the metadata extractor 836 (possibly included in or coupled to a home unit, such as the home unit 124 of FIG. 1). Control then proceeds to block 1758 at which other viewing data such as that described above may be collected. Next, the extracted metadata and other collected viewing data are reported to the central facility 832 for processing (block 1762). Then, at block 1766, the reported metadata and other viewing data is cross-referenced with the reference metadata database created at block 1716. Finally, viewing statistics and/or crediting reports for the VOD programming content consumed at the selected subscriber site is generated by combining the reference metadata information with the other viewing data reported from the subscriber site.

[0093] FIG. 18 illustrates an example process 1800 for monitoring VOD programming that may employ a combination of metered data from an STB (e.g., via the STB monitoring interface 520 of FIG. 5) and from an OSDR (such as the OSDR 622 of FIG. 6). The example process 1800 begins at block 1804 at which data/information collected via the STB monitoring interface 520 is used to determine whether a VOD program has been selected by the STB 516. The STB monitoring interface 520 may also be configured to provide additional metering information related to the viewing of VOD programs (e.g. viewing time, audio muting, pausing, etc.). If the process 1800 determines that a VOD program has not been selected (block 1808), control returns to block 1804. Control continues to loop through block 1804 and 1808 until a VOD program is selected by the STB 516. Otherwise, if a VOD program has been selected (block 1808), control proceeds to block 1812 at which the OSDR 620 is used to determine additional VOD usage information from one or more captured screenshots corresponding to the selected VOD program (e.g., program title information, etc.). By waiting for VOD programming to be selected before processing the captured screenshots, it may be possible to significantly reduce the processing complexity of the monitoring process 1800. Finally, the VOD usage data and any other collected viewing data/information are reported to the central facility 524 for processing and crediting (block 1816).

[0094] FIG. 19 illustrates an example process 1900 for monitoring VOD programming that may employ a combination of metered data from an STB (e.g., via the STB monitoring interface 520 of FIG. 5) and/or an OSDR

(e.g., the OSDR 622 of FIG. 6) with generated content signatures to monitor viewing of VOD content. The example process 1900 begins at block 1904 when one or more reference sites are used to generate reference signatures corresponding to a set of possible VOD programming content (which may be a subset of all possible broadcast programming content). The reference signatures may be sent to a central facility (e.g., the central facility 524) to be included in a reference signature database. The monitoring of VOD programming consumption begins at block 1908 at which, for example, the STB monitoring interface 520 and/or the OSDR 622 (or any similar device) are used to determine whether a VOD program has been selected by the STB 516. At block 1908, additional viewing data may be colleted as described above. If a VOD program has not been selected (block 1912), control returns to block 1908 to wait until a VOD program has been selected. Otherwise, if a VOD program has been selected (block 1912), control proceeds to block 1916.

[0095] At block 1916, one or more signatures are generated based on the VOD program content selected by the STB 516 using any technique known in the art. By waiting for VOD programming to be selected before generating the corresponding content signatures, it may be possible to significantly reduce the processing complexity of the monitoring process 1900. Control then proceeds to block 1920 at which the generated signatures and any other collected viewing data are reported to the central facility 524. Finally, the reported signatures are cross-referenced with the reference signature database to identify the consumed VOD programming content and to generate the corresponding crediting reports and/or viewing statistics.

[0096] FIG. 20 illustrates an example process 2000 for monitoring VOD programming that may employ a combination of metered data from an STB (e.g., via the STB monitoring interface 520 of FIG. 5) and/or an OSDR (e.g., the OSDR 622 of FIG. 6) with ancillary codes to monitor viewing of VOD content. The processing performed by the example process 2000 is similar to that of the example process 1900 of FIG. 19, except that the process 1900 is based on the use of program signatures whereas the process 2000 is based on the use of program ancillary codes. Thus, for brevity, a detailed description of FIG. 20 is not provided herein. Instead, the interested reader if referred to the detailed description of FIG. 19 wherein the generating, processing, reporting and/or cross-referencing of program content signatures in blocks 1904, 1908, 1912, 1916, 1920 and 1924 is replaced in FIG. 20 by the generating, reporting and/or cross-referencing of program content codes in blocks 2004, 2008, 2012, 2016, 2020 and 2024.

[0097] FIGS. 21A and 21B illustrate example processes 2100 and 2150 for monitoring VOD programming that may employ a combination of metadata and metered data from a subscriber site to monitor viewing of VOD content. The example process 2100 of FIG. 21A may be used to collect reference metadata information corresponding to VOD programming content. Such metadata information may include audio/video ancillary codes, audio/video signatures, digital content identifiers (IDs) (e.g., such as Aux Data private data supported by the AC3 audio standard), private content IDs (such as those supported by the MPEG-2 and/or AC3 standards), etc. The example

process 2150 of FIG. 21B may be used to monitor and credit VOD programming content based on metadata information.

[0098] Blocks 1704, 1708, 1712 and 1716 of process 2100 are substantially identical to the corresponding blocks in the process 1700 of FIG. 17A. For brevity, these blocks are not re-described here. Rather, the interested reader is referred to the description of FIG. 17A for a detailed discussion of the above-identified blocks.

[0099] The example process 2150 begins at block 2154 at which, for example, an STB monitoring interface (such as the STB monitoring interface 520 of FIG. 5) and/or an OSDR (such as the OSDR 622 of FIG. 6), or any similar device, is used to determine whether a VOD program has been selected by a STB (such as the STB 516 of FIG. 5). At block 2158, additional viewing data may also be collected as described above. If a VOD program has not been selected (block 2158), control returns to block 2154 to wait until a VOD program has been selected. Otherwise, if a VOD program has been selected (block 2158), control proceeds to block 1754.

[00100] Blocks 1754, 1758, 1762, 1766 and 1770 of process 2150 are substantially identical to the corresponding blocks in the process 1750 of FIG. 17B. For brevity, these blocks are not re-described here. Rather, the interested reader is referred to the description of FIG. 17B for a detailed discussion of the above-identified blocks.

[00101] FIG. 22 is a block diagram of an example computer 2200 capable of implementing the apparatus and methods disclosed herein. The computer 2200 can be, for example, a server, a personal computer, a

personal digital assistant (PDA), an Internet appliance, or any other type of computing device.

[00102] The system 2200 of the instant example includes a processor 2212. For example, the processor 2212 can be implemented by one or more Intel® microprocessors from the Pentium® family, the Itanium® family or the XScale® family. Of course, other processors from other families are also appropriate. A processor such as processor 2212 may be used to implement any or all of the home unit 124 and/or STB 108 (or portions thereof) of FIG. 1 and/or the central facility processor 224 (or portions thereof) of FIG. 2.

[00103] The processor 2212 is in communication with a main memory including a volatile memory 2214 and a non-volatile memory 2216 via a bus 2218. The volatile memory 2214 may be implemented by Static Random Access Memory (SRAM), Synchronous Dynamic Random Access Memory (SDRAM), Dynamic Random Access Memory (DRAM), RAMBUS Dynamic Random Access Memory (RDRAM) and/or any other type of random access memory device. The non-volatile memory 2216 may be implemented by flash memory and/or any other desired type of memory device. Access to the main memory 2214, 2216 is typically controlled by a memory controller (not shown) in a conventional manner.

[00104] The computer 2200 also includes a conventional interface circuit 2220. The interface circuit 2220 may be implemented by any type of well-known interface standard, such as an Ethernet interface, a

universal serial bus (USB), and/or a third generation input/output (3GIO) interface.

[00105] One or more input devices 2222 are connected to the interface circuit 2220. The input device(s) 2222 permit a user to enter data and commands into the processor 2212. The input device(s) can be implemented by, for example, a keyboard, a mouse, a touchscreen, a track-pad, a trackball, an isopoint and/or a voice recognition system.

[00106] One or more output devices 2224 are also connected to the interface circuit 2220. The output devices 2224 can be implemented, for example, by display devices (e.g., a liquid crystal display, a cathode ray tube display (CRT)), by a printer and/or by speakers. The interface circuit 2220, thus, typically includes a graphics driver card.

[00107] The interface circuit 2220 also includes a communication device such as a modem or network interface card to facilitate exchange of data with external computers via a network 2226 (e.g., an Ethernet connection, a digital subscriber line (DSL), a telephone line, coaxial cable, a cellular telephone system, etc.). The interface circuit 2220 and the network 2226 may implement the connection 140 of FIG. 1.

[00108] The computer 2200 also includes one or more mass storage devices 2228 for storing software and data. Examples of such mass storage devices 2228 include floppy disk drives, hard drive disks, compact disk (CD) drives and DVD drives. The mass storage device 2228 and/or the volatile memory 2214 may be used to store the viewing records in the home unit 124 of FIG. 1.

[00109] As an alternative to implementing the methods and/or apparatus described herein in a system such as the device of FIG. 22, the methods and or apparatus described herein may be embedded in a structure such as a processor and/or an ASIC (application specific integrated circuit).

[00110] Although certain example methods, apparatus and articles of manufacture have been described herein, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all methods, apparatus and articles of manufacture fairly falling within the scope of the appended claims either literally or under the doctrine of equivalents.

ABSTRACT

Methods and apparatus to determine audience viewing of video-on-demand programs are disclosed. An example method disclosed herein comprises creating a reference database corresponding to a set of VOD programs, determining whether a VOD program is selected at a subscriber site, extracting at least one identifier from a signal carrying the VOD program, and cross-referencing the at least one identifier with the reference database.

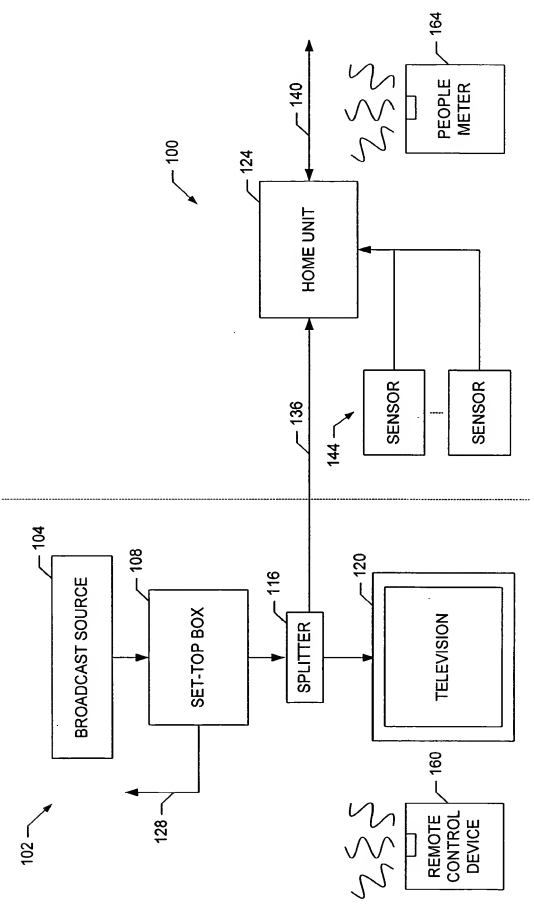
100
102
104
BROADCAST SOURCE
108
SET-TOP BOX
116
SPLITTER
120
TELEVISION
128
136
140
144
SENSOR
SENSOR
124
HOME UNIT
160
REMOTE CONTROL DEVICE
164
PEOPLE METER

FIG. 1

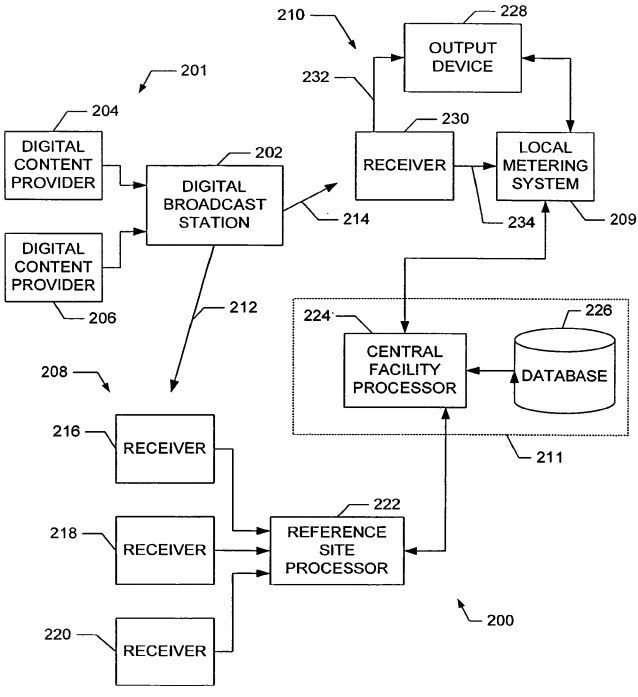
210
228
OUTPUT DEVICE
201
232
204
DIGITAL CONTENT PROVIDER
202
DIGITAL BROADCAST STATION
230
RECEIVER
LOCAL METERING SYSTEM
214
234
209
DIGITAL CONTENT PROVIDER
206
212
224
226
CENTRAL FACILITY PROCESSOR
DATABASE
208
211
216
RECEIVER
222
218
RECEIVER
REFERENCE SITE PROCESSOR
200
220
RECEIVER

FIG. 2

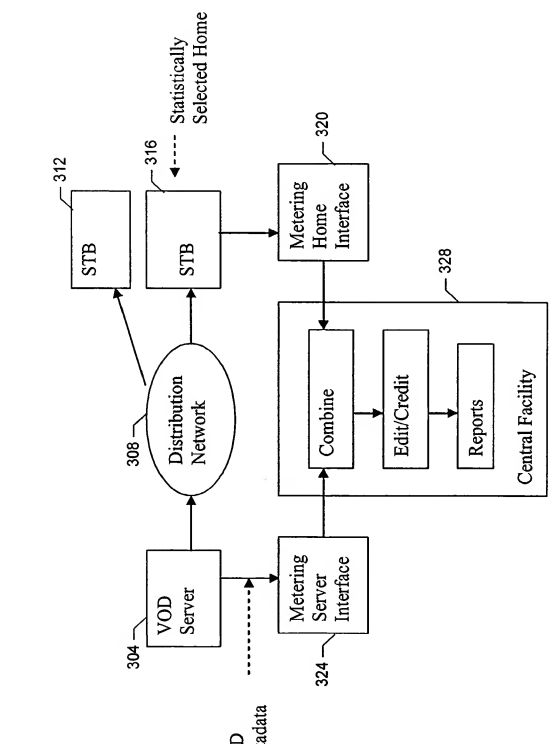
VOD Metadata
304
VOD Server
Metering Server Interface
324
308
Distribution Network
312
STB
316
STB
Statistically Selected Home
320
Metering Home Interface
328
Combine
Edit/Credit
Reports
Central Facility

FIG. 3

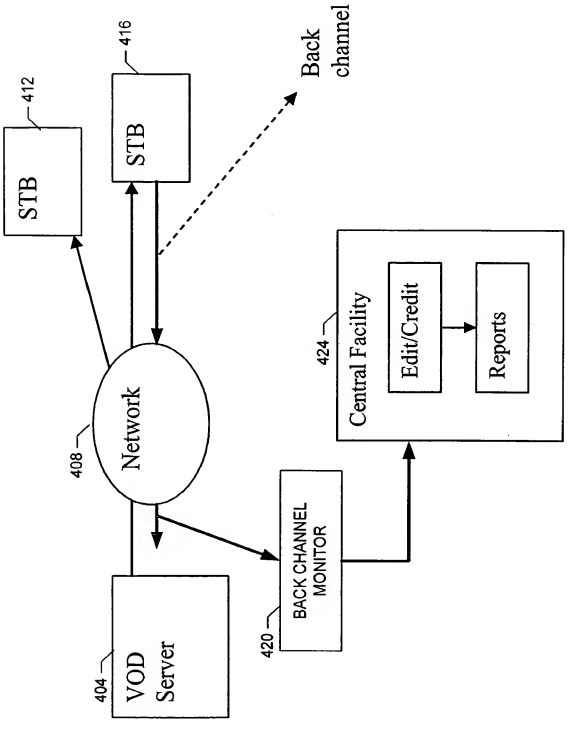
STB
412
STB
416
Back channel
Network
408
Central Facility
424
Edit/Credit
Reports
BACK CHANNEL MONITOR
420
VOD Server
404

FIG. 4

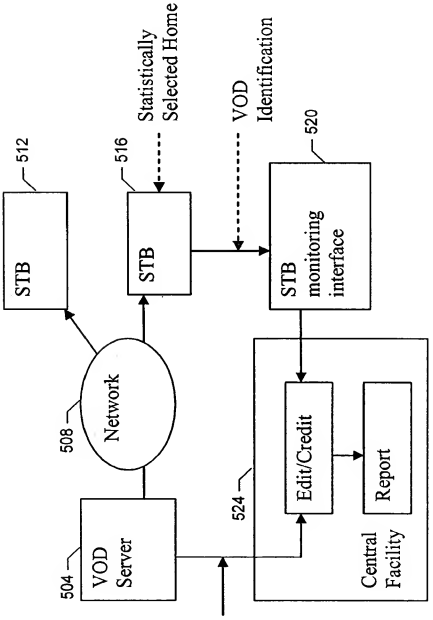
Title Information
504
VOD Server
508
Network
512
STB
516
STB
Statistically Selected Home
VOD Identification
520
STB monitoring interface
524
Edit/Credit
Report
Central Facility

FIG. 5

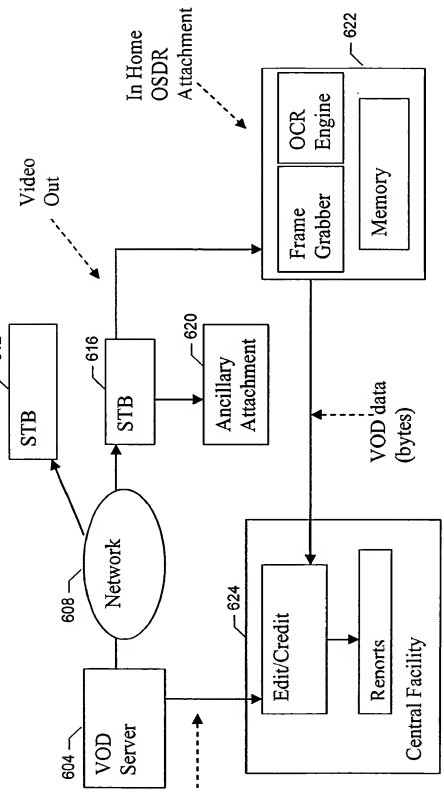
VOD Titles
604
VOD Server
608
Network
624
Edit/Credit
Reports
Central Facility
VOD data (bytes)
612
STB
616
STB
620
Ancillary Attachment
Video Out
In Home OSDR Attachment
622
Frame Grabber
OCR Engine
Memory

FIG. 6

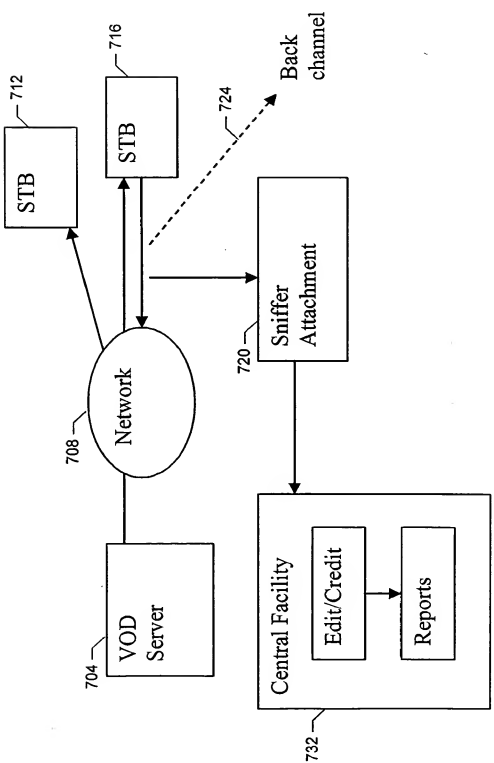
712
STB
716
STB
724
Back channel
708
Network
720
Sniffer Attachment
704
VOD Server
Central Facility
Edit/Credit
Reports
732

FIG. 7

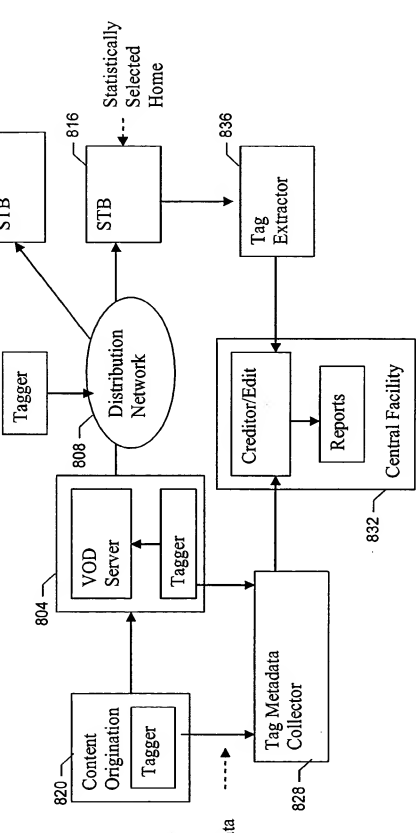
812
STB
816
STB
Statistically Selected Home
836
Tag Extractor
824
Tagger
808
Distribution Network
804
VOD Server
Tagger
Creditor/Edit
Reports
Central Facility
832
820
Content Origination
Tagger
Tag Metadata Collector
828
Metadata

FIG. 8

Server site techniques: Metering data collection from VOD server only

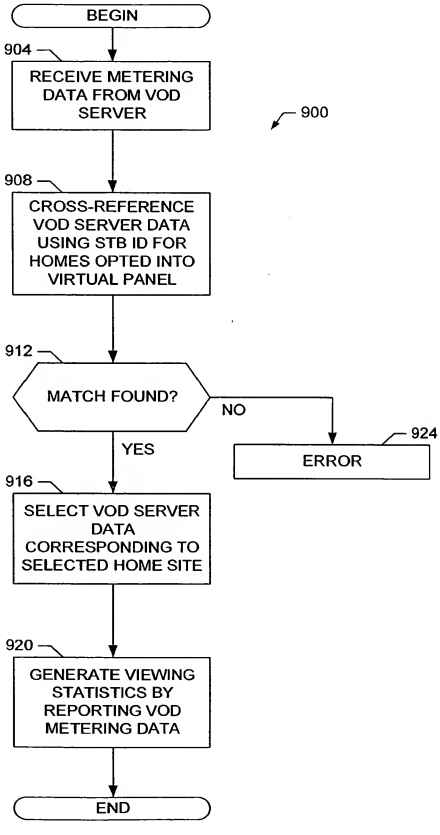

FIG. 9

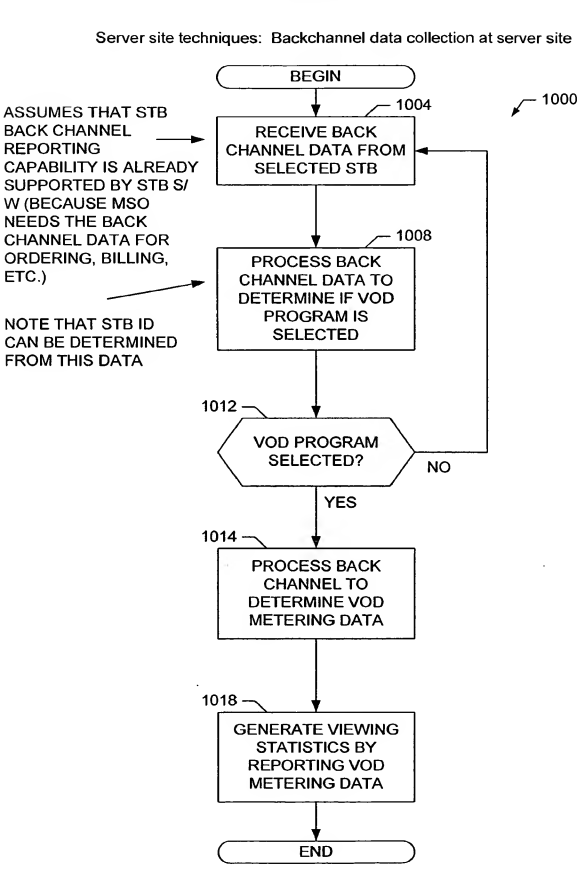
Server site techniques: Backchannel data collection at server site
BEGIN
1000
1004
ASSUMES THAT STB BACK CHANNEL REPORTING CAPABILITY IS ALREADY SUPPORTED BY STB S/W (BECAUSE MSO NEEDS THE BACK CHANNEL DATA FOR ORDERING, BILLING, ETC.)
RECEIVE BACK CHANNEL DATA FROM SELECTED STB
1008
PROCESS BACK CHANNEL DATA TO DETERMINE IF VOD PROGRAM IS SELECTED
NOTE THAT STB ID CAN BE DETERMINED FROM THIS DATA
1012
VOD PROGRAM SELECTED?
NO
YES
1014
PROCESS BACK CHANNEL TO DETERMINE VOD METERING DATA
1018
GENERATE VIEWING STATISTICS BY REPORTING VOD METERING DATA
END

FIG. 10

Home site techniques: Data collection from STB monitoring (non-invasive via software meter)

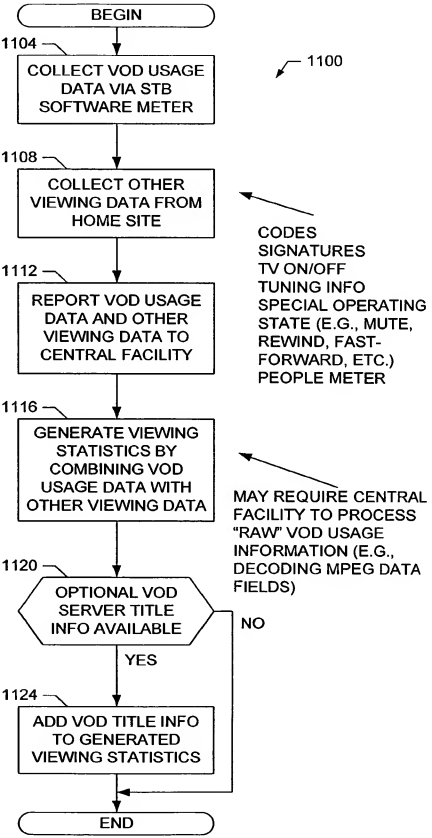

FIG. 11

Home site techniques: Data collection from STB monitoring (invasive via bus sniffing)

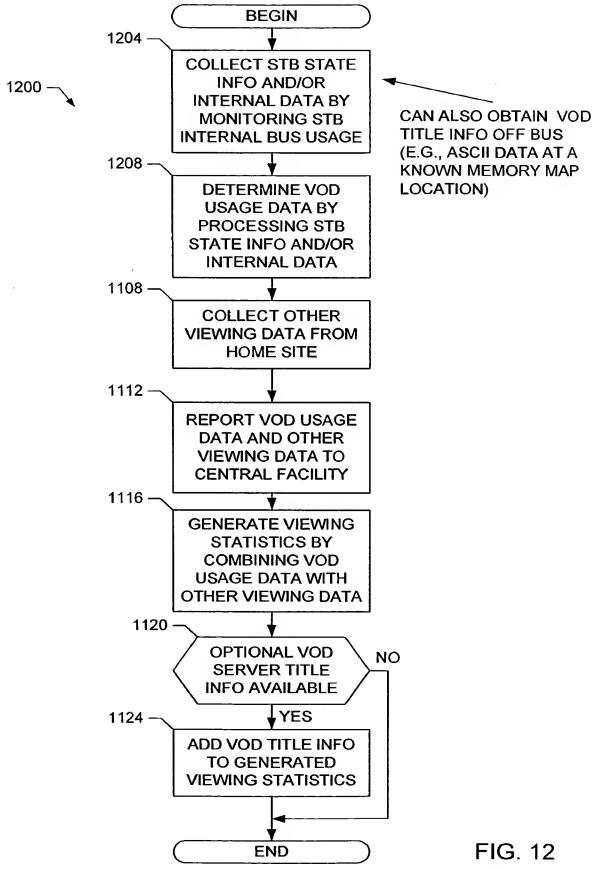

FIG. 12

Home site techniques: STB data reporting directly to monitoring central facility

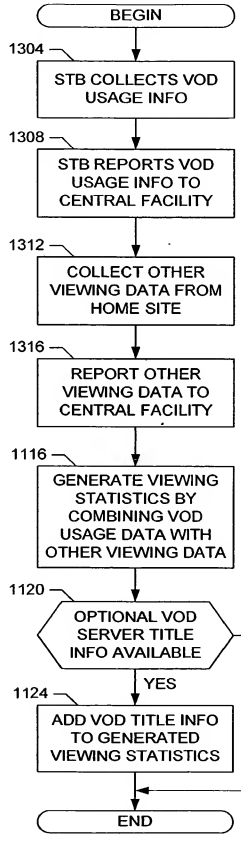

FIG. 13

Home site techniques: Data collection with OSDR techniques

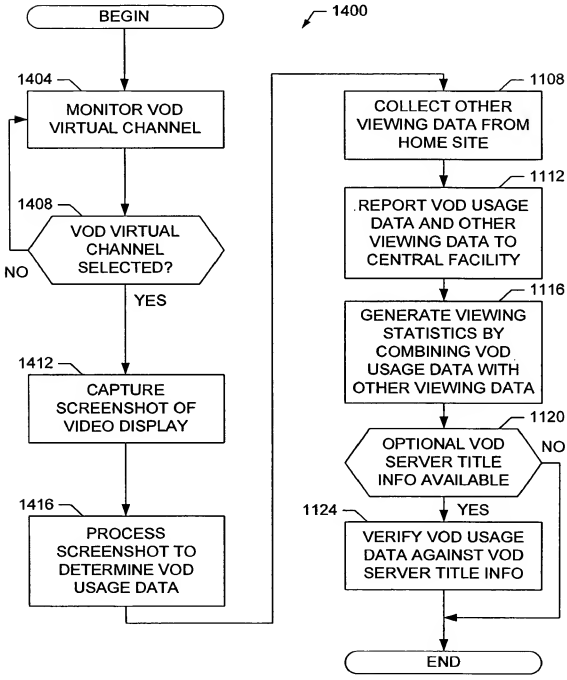

FIG. 14

Home site techniques: Data sniffing approaches (broadcast data signal and backchannel signal)

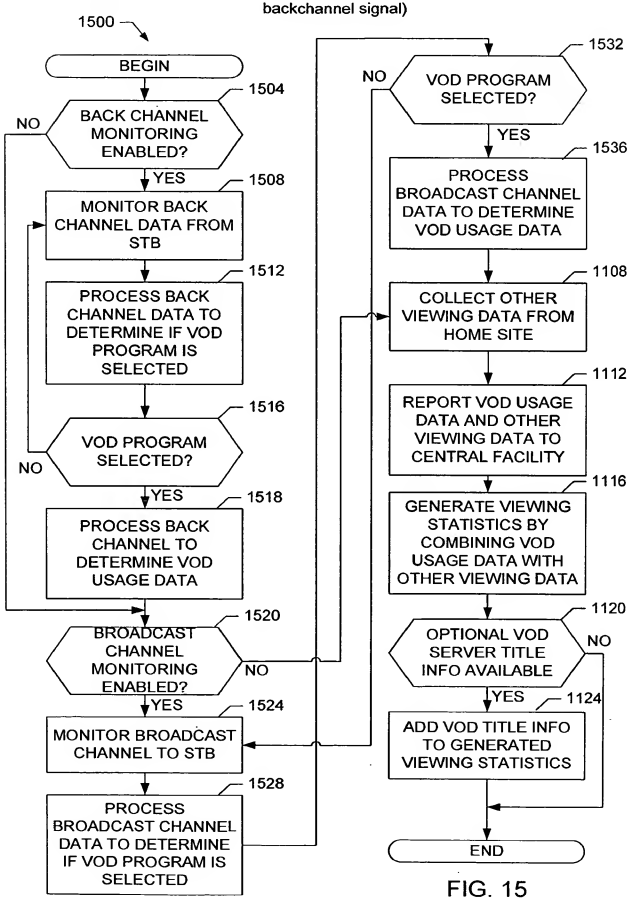

FIG. 15

Hybrid techniques: Data collection from VOD server correlated with data collected from STB

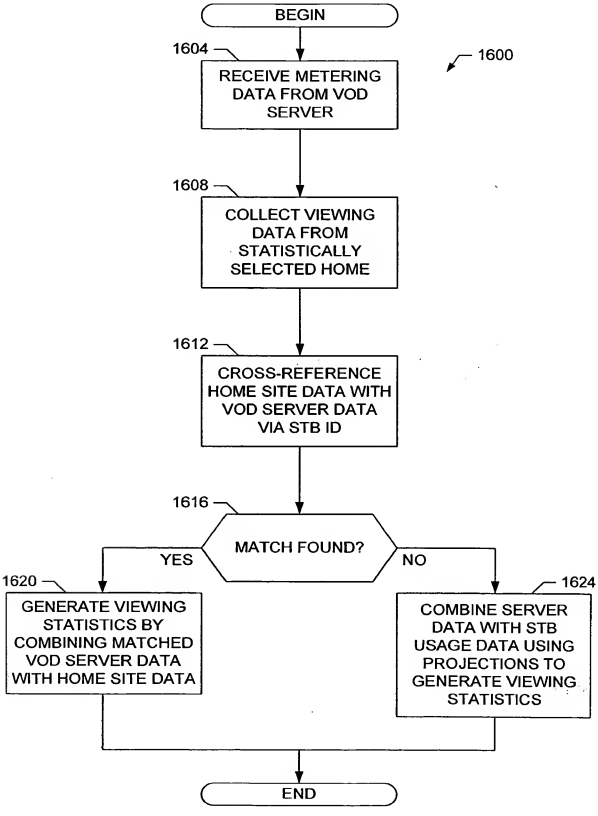

FIG. 16

Hybrid techniques: Metadata use in the headend and upstream

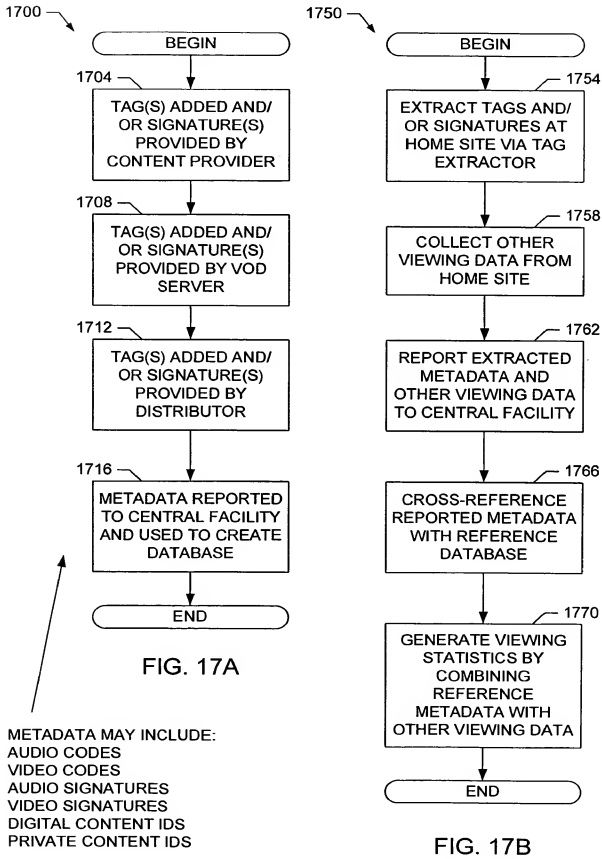

FIG. 17A

FIG. 17B

Hybrid techniques: Combine data collection from STB with OSDR monitoring

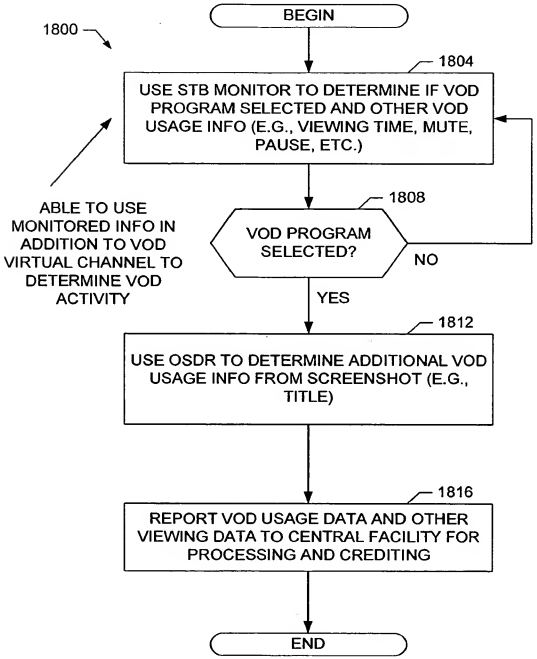

FIG. 18

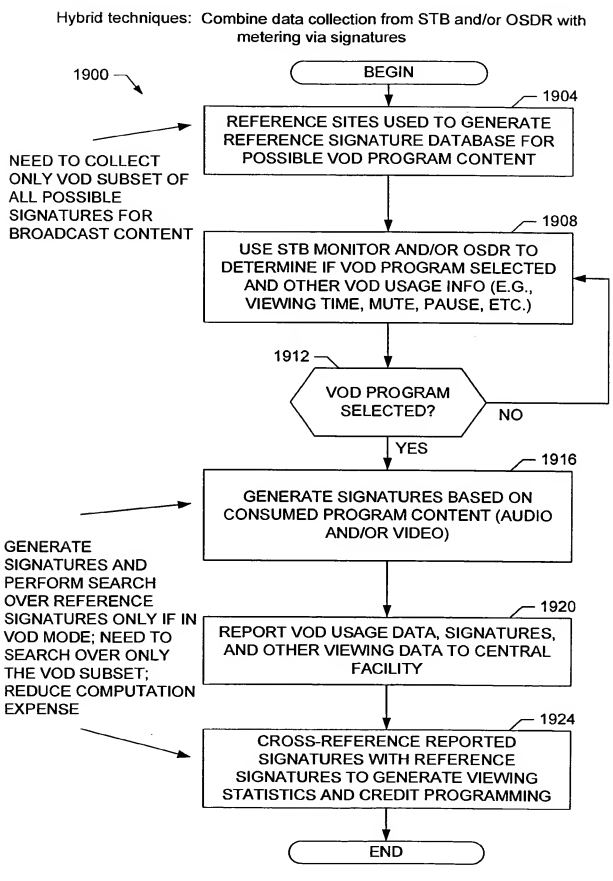
Hybrid techniques: Combine data collection from STB and/or OSDR with metering via signatures
1900
BEGIN
1904
REFERENCE SITES USED TO GENERATE REFERENCE SIGNATURE DATABASE FOR POSSIBLE VOD PROGRAM CONTENT
NEED TO COLLECT ONLY VOD SUBSET OF ALL POSSIBLE SIGNATURES FOR BROADCAST CONTENT
1908
USE STB MONITOR AND/OR OSDR TO DETERMINE IF VOD PROGRAM SELECTED AND OTHER VOD USAGE INFO (E.G., VIEWING TIME, MUTE, PAUSE, ETC.)
1912
VOD PROGRAM SELECTED?
NO
YES
1916
GENERATE SIGNATURES BASED ON CONSUMED PROGRAM CONTENT (AUDIO AND/OR VIDEO)
GENERATE SIGNATURES AND PERFORM SEARCH OVER REFERENCE SIGNATURES ONLY IF IN VOD MODE; NEED TO SEARCH OVER ONLY THE VOD SUBSET; REDUCE COMPUTATION EXPENSE
1920
REPORT VOD USAGE DATA, SIGNATURES, AND OTHER VIEWING DATA TO CENTRAL FACILITY
1924
CROSS-REFERENCE REPORTED SIGNATURES WITH REFERENCE SIGNATURES TO GENERATE VIEWING STATISTICS AND CREDIT PROGRAMMING
END

FIG. 19

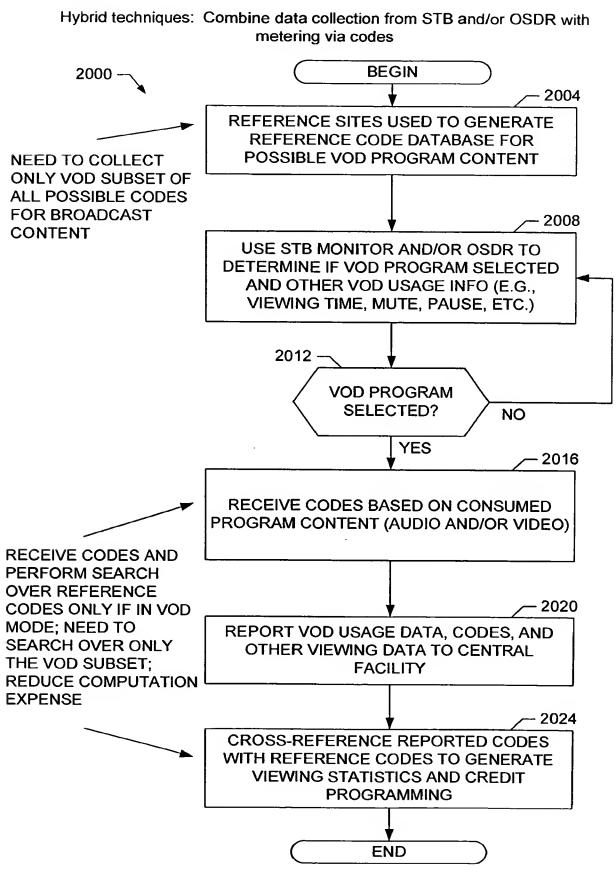
Hybrid techniques: Combine data collection from STB and/or OSDR with metering via codes
2000
BEGIN
2004
REFERENCE SITES USED TO GENERATE REFERENCE CODE DATABASE FOR POSSIBLE VOD PROGRAM CONTENT
NEED TO COLLECT ONLY VOD SUBSET OF ALL POSSIBLE CODES FOR BROADCAST CONTENT
2008
USE STB MONITOR AND/OR OSDR TO DETERMINE IF VOD PROGRAM SELECTED AND OTHER VOD USAGE INFO (E.G., VIEWING TIME, MUTE, PAUSE, ETC.)
2012
VOD PROGRAM SELECTED?
NO
YES
2016
RECEIVE CODES BASED ON CONSUMED PROGRAM CONTENT (AUDIO AND/OR VIDEO)
RECEIVE CODES AND PERFORM SEARCH OVER REFERENCE CODES ONLY IF IN VOD MODE; NEED TO SEARCH OVER ONLY THE VOD SUBSET; REDUCE COMPUTATION EXPENSE
2020
REPORT VOD USAGE DATA, CODES, AND OTHER VIEWING DATA TO CENTRAL FACILITY
2024
CROSS-REFERENCE REPORTED CODES WITH REFERENCE CODES TO GENERATE VIEWING STATISTICS AND CREDIT PROGRAMMING
END

FIG. 20

Hybrid techniques: Metadata use combined with VOD usage detection

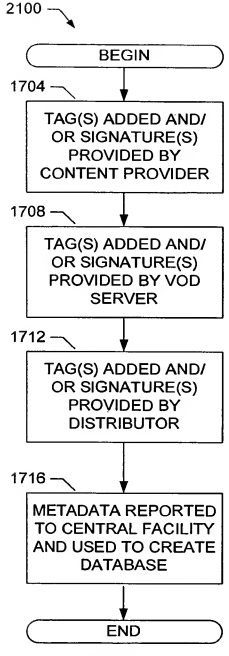

FIG. 21A

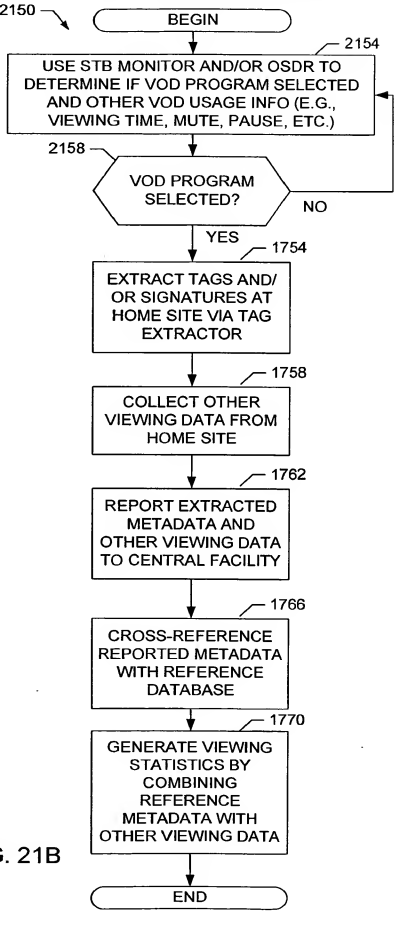

FIG. 21B

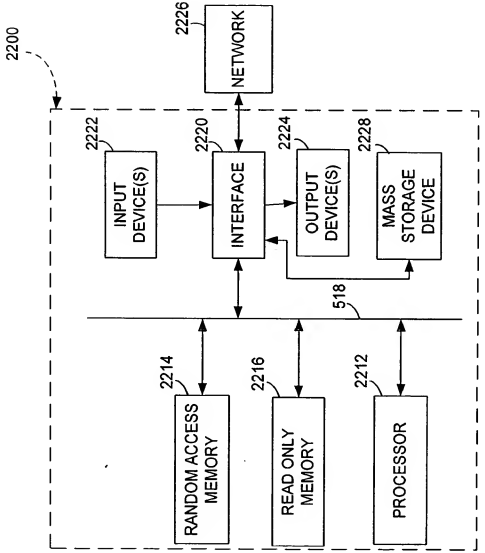
2200
2226
NETWORK
2222
INPUT DEVICE(S)
2220
INTERFACE
2224
OUTPUT DEVICE(S)
2228
MASS STORAGE DEVICE
518
2214
RANDOM ACCESS MEMORY
2216
READ ONLY MEMORY
2212
PROCESSOR

FIG. 22